

# CENTER FOR BEAM PHYSICS SEMINAR

## “Historical Roots of Gauge Invariance”

J. D. Jackson (UCB/LBNL)

Friday January 11, 2002, 10:30 AM  
Albert Ghiorso Conference Room (71-264), LBNL

Abstract: A number of reviews of gauge theories cover the period from about 1929 (Weyl's major paper on the subject) to the present day, with stress on the post-Yang-Mills epoch. Lev Okun and I address the "pre-history" of the subject, starting with Ampère, Neumann, Weber, and others, and the debates over the "correct" form of the vector potential. The story continues with Maxwell, Lorenz, Helmholtz, Clausius, and Lorentz by which time the idea of different, equivalent gauges for the potentials in classical electromagnetism had been clarified completely. We then discuss the *annus mirabilis*, 1926, with Fock's discovery of the phase transformation of the wave function that must accompany a gauge change of the potentials. The unfair belittlement of the contributions of Lorenz and Fock are aired. Portraits of all the "electricians" will be presented as the story unfolds. [Reference: J. D. Jackson and Lev Okun, Rev. Mod. Phys. Vol. 73, 663-680 (2001)]

Biographical data: Dave Jackson is a Professor Emeritus of Physics, UC Berkeley, and a Senior Physicist at LBNL since 1967. He is the author of a well-known text, *Classical Electrodynamics*. His research interests are mainly in particle physics, but in his retirement he has been writing pedagogical articles in the American Journal of Physics as well as the recent foray into the history of science.